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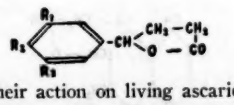
IN VITRO OBSERVATIONS ON THE ANTHELMINTIC ACTION OF SOME SYNTHETIC LACTONES AND COMPOUNDS ALLIED TO SANTONIN

(MISS) K. D. PARANJAPE, B.A., B.SC., PH.D.,
N. L. PHALNIKAR, M.SC., PH.D., A.R.I.C.,
B. V. BHIDE, M.SC., A.I.I.SC.
AND
K. S. NARGUND, M.SC., PH.D., A.I.I.SC., D.I.C.
Maharaja Pratapsinh Chemical Laboratory,
Sir Parasurambhau College, Poona

A systematic study of the relation between the chemical constitution and the anthelmintic action was first taken up by Hall and Wigdor (1918 and 1919). Caius and Mhasker (1919, 1921, 1922 and 1923) have also made a study of a large number of anthelmintic drugs, particularly (*a*) halogenated hydrocarbons, (*b*) phenols, thymol and β-naphthol, and (*c*) santonin, desmotroposantonin and their derivatives. They have shown that the anthelmintic property of a drug is due to the phenolic hydroxyl group and the benzenoid part of the molecule. From the study of the anthelmintic action of santonin and desmotroposantonin they conclude that a group —CO—CH=CH—which is present in santonin is responsible for the anthelmintic action and that desmotroposantonin is not a good anthelmintic. They deny the fact that a lactone group is responsible for the anthelmintic action.

Oettingen (1929 and 1930), however, has shown that angelica lactones and their derivatives with aromatic aldehydes are good anthelmintics and in this group of substances, it is the lactonic group that appears to be responsible for the anthelmintic action. The double bond in the lactonic ring increases the anthelmintic property. Later in 1934 Rosenmund and Schapiro (1934) have prepared a number of lactones of the type



and have studied their action on living ascarides.

In discussing the correlation between chemical constitution and the anthelmintic action of drugs, due consideration must be given to the physical properties of the drugs, such as solubility in water and in lipoids, diffusion and absorption of the drug. Even in the absence of knowledge of the physical properties, the following broad conclusions can be drawn from the results of Rosenmund and Schapiro:—

(*i*) A butyro lactone ring attached to a benzene ring is essential in an anthelmintic.

(*ii*) The benzene nucleus should have a hydroxyl or methoxyl group as a substituent.

(*iii*) The ortho position of the benzene ring with respect to the attachment of the lactone ring should be free.

With a view to obtain further information on this issue a number of lactones and compounds related to santonin have been synthesised, and described in a series of papers by Nargund and his collaborators (1940 and 1943). The aim of the present study is to find out from the number of these synthetic products drugs which are capable of being good anthelmintics so that they may be used for further *in vivo* tests and for clinical trials.

EXPERIMENTAL

Hall (1926), recommends experiments on dogs *in vivo*. However, experiments *in vivo* are difficult to carry out.

Straub, Brunning and others (1916) tested anthelmintics on round worms *in vitro*. It is difficult to obtain and preserve parasitic worms in the living condition; so that Straub and Trendelenburg (1916) employed earthworms for tests *in vitro*. Sollmann (1919) regards the action of anthelmintics on earth worms to be similar to the action on helminths. He has shown that all known anthelmintics are toxic to earthworms and therefore Sollmann proposed a simple immersion method for the tests of anthelmintics.

Chopra and Chandler (1928) point out that earthworms belong to a totally different zoological group from the helminths and therefore experiments carried on them are rough at best. However Sollmann's method has been recommended by the International Conference at Edinburgh and Geneva and by the Hygiene Committee of the League of Nations. Therefore in the present work this simple immersion method of Sollmann has been used.

Three earthworms (local species of Pheretima Elongata) of approximately the same size were suspended in 100 c.c. of a solution of the substances. It was found that the earthworms lose their activity after immersion in the fluid containing the drug for some time. The time required for this depression of activity in solutions of different concentrations was noted. It is denoted in the tables as "S". In some cases the toxicity was so great that the worms actually died. The time for the occurrence of death has been denoted by "D". The time was measured in minutes. A control experiment was made with Santonin solution (0·02%). The time required for the depression of activity in a 0·02%solution of santonin was 30 minutes and for death it was 120 minutes. The control experiment was useful in comparing the activity of the drug with that of a standard drug. The concentrations with the compounds tested used were 0·02, 0·015, 0·01 and 0·005. The results obtained from 0·02% solution of the drug were found to be useful for comparison as solutions of lower concentrations did not produce any pronounced effect in most of the cases and so only those have been given below.

After the study of toxicity to earthworms, the toxicity to small fresh water fish (young specimens 4 to 5 cm. long) was tested. The fresh water fish were kept in 100 c.c.s of a 0·02%

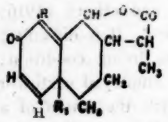
solution of the substance. A control experiment was always made with a santonin solution of the same concentration. The time required for the death of the fish was noted and is shown in tables as "D". Death occurred in the case of santonin in 25 minutes. The accuracy was 2 minutes and the results were reproducible within these limits.

Results and Discussion

For the sake of convenience the results are divided into two sections. *Section A* describes the following lactones.

(1) Lactones of 7 keto 8-10 di-alkyl Δ 5-6, 8-9 hexahydronaphthalene 2 propionic acids (santonin and santonin analogues). Table No. 1.
(2) 7 keto 8-10 di-alkyl Δ 5-6, 8-9, hexahydronaphthalene. Table No. 2.
(3) Miscellaneous dienones. Table No.3.
(4) Compounds related to desmotroposantonin. Tables 4a, 4b.
(5) Tetrahydronaphthols obtained by the transformation of 7 keto 8-10 di-alkyl △5-6, 8-6, hexahydronaphthalenes. Table 5.

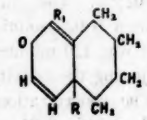
Table No. 1—Santonin and Santonin Analogues



Compound	*On earthworms*	*On fish*
No. 1 $R = R_1 = CH_3$	S = 30	
Synthetic santonin	D = 120	D = 25
No. 2 $R_1 = CH_3$	S = 30	
R = H	D = 120	D = 35
No. 3 R_1 = H	S = 30	
$R = CH_3$	D = 120	D = 45
No. 4 $R = R_1$ = H	S = 45	
	D = 120	D = 60

The specimen of synthetic santonin used was the unresolved sample having $[\alpha]_D = -154°$. It has been found that natural santonin has $[\alpha]_D = -172°$ and the synthetic sample is a mixture of two isomers of santonin, one having $[\alpha]_D = -108°$ (unpublished observation). The results show that the two forms are equally toxic to fish and earth worms. The compound related to santonin (No. 2) contains an angular methyl group. Its toxicity to earth worms is the same as that of santonin but in the case of fish it is less toxic. The other two compounds, Nos. 3 and 4, are difinitely less toxic than santonin both towards earth worms and fish.

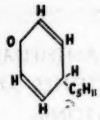
Table No. 2 — 7 keto 8-10 di-alkyl Δ 5-6, 8-9, hexahydronaphthalenes



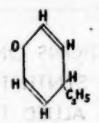
Compound	*On earthworms*	*On fish*
No. 1 $R_1 = CH_3$	S = 30	
R = CH_3	D = 90	D = 6
No. 2 R = CH_3	S = 60	
R_1 = H	D = 90	D = 6
No. 3 R = H	S = 60	
$R_1 = CH_3$	No death	D = 10
No. 4 R = H	S = 60	
R_1 = H	No death	D = 10

The substances described in Table 2 contain the dienone structure as in santonin but do not contain the lactone ring. They are all toxic to earth worms and fish but the simple dienones (Table No. 3) are comparatively more toxic. Here again the angular methyl group appears to increase the toxicity of the substance. This influence is more pronounced in these compounds than in those tabulated in Table No. 1.

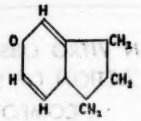
Table No. 3—Miscellaneous Dienones



No. 1



No. 2

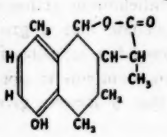


No. 3

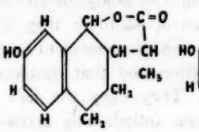
Compound	*On earthworms*	*On fish*
No. 1.	S = 30	
	D = 90	D = 5
No. 2.	S = 30	
	D = 90	D = 5
No. 3.	S = 30	
	D = 90	D = 10

Toxicity towards fish is more pronounced in the dienones than in santonin and related substances. There are some minor differences in toxicity but no definite conclusions can be drawn as the method of measurement of toxicity is only approximate. It appears, therefore, that the lactone group in santonin does not contribute to its toxicity. The dienone structure on the other hand appears to be the more important factor in inducing toxicity.

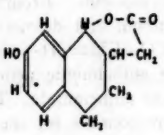
Table No. 4(a)—Compounds Related to Desmotroposantonin



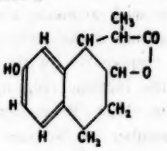
No. 1



No. 2



No. 3



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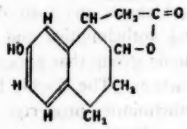
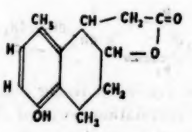


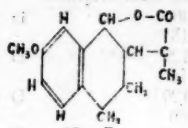
No. 5



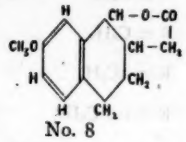
No. 6

Compound	*On earthworms*	*On fish*
No. 1. Desmotropo-santonin	No depression	No depression
No. 2.	S = 15. Skin affected	
	D = 45	D = 10
No. 3.	S = 20 " "	
	D = 45	D = 10
No. 4.	S = 7·5 " "	
	D = 45	No death.
No. 5.	S = 7·5 " "	
	D = 45	"
No. 6.	S = 7·5 " "	
	D = 45	"

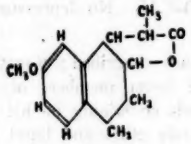
TABLE No. 4(b)—COMPOUNDS RELATED TO DESMOTROPOSANTONIN



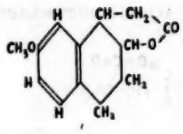
No. 7



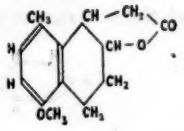
No. 8



No. 9



No. 10



No. 11

Compound	*On earthworms*	*On fish.*
No. 7.	S = 45 D = 180	D = 10
No. 8.	S = 45 D = 180	D = 10
No. 9.	S = 60 No death	No. death
No. 10.	S = 60 No death	No. death
No. 11.	S = 60 D = 90 Skin affected	No. death

Compounds tested in Table Nos. 4 (a), 4 (b) are similar in structure to desmotroposantonin with the difference in the attachment of the lactone ring (compounds nos. 4,5,6,10 and 11) and in the presence or absence of methyl groups (compounds No. 6 & 11). These are divided into groups; Table No. 4(*a*), Table No. 4(*b*). Table 4(*a*) contains compounds having free phenolic OH group, while 4(*b*) consists of compounds containing the OCH_3 group instead of the OH group.

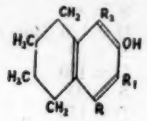
Desmotroposantonin is not at all toxic either to earthworms or to fish. This observation is an agreement with that of Caius and Mhasker.

All the phenolic compounds are highly toxic to earthworms. (Compounds from Table No. 4(*a*)). Their skin is rapidly attacked and finally peels off. It is curious enough that compound No. 11, although it has no free OH group and is less toxic than the corresponding phenolic compounds, attacks the skin of the earthworms.

The position of the lactonic oxygen appears to have considerable effect on the toxicity to earth worms. The lactonic oxygen in position 2 is more toxic than the lactonic oxygen in position 1 (Nos. 4, 5, 6, 9, 10 and 11). However, the substances with the lactonic oxygen in 2 position are not at all toxic to fish while those containing lactonic oxygen in 1 position are toxic.

The nontoxicity of desmotroposantonin and other related substances cannot be attributed to the chemical constitution as the structures are similar. The differences are probably due to other physical properties such as solubility, adsorption, etc. The determination of such properties is likely to give important results.

TABLE No. 5—TETRAHYDRO-NAPHTHOLS



	Compounds	*On earthworms*	Remarks
No. 1.	$R = R_2 = R_1 = H$	S = 120	No death
No. 2.	$R = CH_3$ $R_1 = R_2 = H$	S = 120	"
No. 3.	$R_2 = CH_3 = R$ $R_1 = H$	S = 60	"
No. 4.	$R_2 = CH_3$ $R = R_1 = H$	S = 60	"

Table No. 5 contains the results obtained with tetrahydronaphthols. These tetrahydronaphthols have been obtained by the action of mineral acids on the corresponding dienones (Table No. 2), a change similar to the conversion of santonin into desmotroposantonin. These substances are far less toxic than santonin and the dienones and so were not tried on fish. These substances present a case parallel to desmotroposantonin, desmotroposantonin being inactive.

The following generalisations can be made from the foregoing observations:—

(1) The angular methyl group definitely increases toxicity.

(2) Tetrahydronapthols are far less toxic than the corresponding dienones.

(3) The dienones, santonin and santonin analogues are toxic.

(4) Lactones derived from tetrahydronaphthols and the corresponding tetrahydronaphthyl ethers are more toxic than the tetrahydronaphthols themselves. Here it appears that the lactone ring is essential to give toxic properties to these substances.

(5) When the lactone group and the dienone structure are simultaneously present, undoubtedly the dienone structure is the more important factor in inducing toxicity.

SECTION (B)

In this section are described the results of experiments carried on with butyrolactones constituting nine different series. They are:—

(1) γ p-alkoxy phenyl γbutyrolactones. (Table 6.)

(2) β p-methoxy (hydroxy) phenyl γ alkyl γ butyrolactones. (Table 7.)

(3) γ p-methoxy phenyl γ alkyl γ butyrolactones. (Table 8.)

(4) γ phenyl γalkyl substituted γ butyrolactones. (Table 9.)

(5) γ p-methoxy phenyl α alkyl γ butyrolactone. (Table 10.)

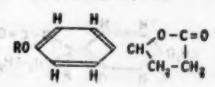
(6) γ p-methoxy—3 methyl phenyl α alkyl γ butyrolactones. (Table 11.)

(7) γ p-methoxy—3 methyl phenyl γ alkyl γ butyrolactones. (Table 12.)

(8) γ 2methoxy—5 alkyl phenyl γ butyrolactones. (Table 13.)

(9) Miscellaneous lactones. (Table 14.)

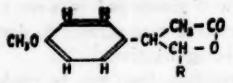
TABLE No. 6—γ P-ALKOXY PHENYL γ BUTYROLACTONES



Compound	On earthworms	On fish.
No. 1. R = CH_3	S = 30 D = 120 Skin attacked	D = 35
No. 2. R = C_2H_5	S = 30 D = 150 „ „	D = 35
No. 3. R = nC_4H_9	S = 45 D = 150 „ „	D = 40
No. 4. R = iso C_4H_9	S = 15 D = 120 Skin attacked	D = 25
No. 5. R = iso C_5H_{11}	S = 45 D = 140 ,	No death
No. 6. R = nC_6H_{13}	Sliht depression No death	No death

Here the alkoxy group has been varied from CH_3O to $C_6H_{13}O$. The activity is the greatest when the iso-butoxy group is introduced. Increasing the alkoxy group to hexoxy group diminishes considerably the toxicity both to fish and to earthworms. All the compounds except the last two attacked the skin of the earth worms.

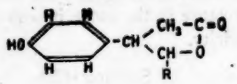
TABLE No. 7(a)—β P-METHOXY PHENYL γ ALKYL γ BUTYROLACTONES



Compound	On earthworms	On fish.
No. 1. R = $nC_{16}H_{33}$	No depression	Not tried.
No. 2. R = $nC_{14}H_{29}$	„ „	„
No. 3. R = nC_5H_{11}	S = 30 D = 60 Skin attacked	D = 15
No. 4. R = nC_3H_7	S = 15 D = 60 Skin attacked	D = 10
No. 5. R = nC_2H_5	S = 15 D = 60 Skin attacked	D = 10

In this series of compounds, alkyl groups are introduced in the γ position of the butyrolactone structure and the β-position is occupied by p-methoxy phenyl radical. The higher homologues are insoluble in water and almost inactive.

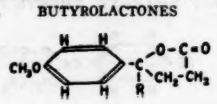
TABLE No. 7(b)—β P-HYDROXY PHENYL γ ALKYL γ BUTYROLACTONES



Compounds	On earthworms	On fish
No. 6. R = $nC_{16}H_{33}$	No depression	Not tried
No. 7. R = $nC_{14}H_{29}$	„ „	„
No. 8. R = nC_5H_{11}	S = 10 Skin attacked D = 20	D = 10
No. 9. R = nC_3H_7	S = 10 Skin attacked D = 20	D = 5
No. 10. R = nC_2H_5	S = 10 Skin attacked D = 60	D = 5

In this series of compounds alkyl groups are introduced in the γ-position and the β-position is occupied by p-hydroxy phenyl radical. The compounds containing the phenolic OH group are more toxic than the corresponding methoxy compounds (Table 7(a)) as is to be expected. The ethyl and propyl substituted butyrolactones are more toxic than santonin and on increasing the number of carbon atoms the toxicity is rapidly diminished. The lower homologues attacked the skin.

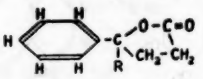
TABLE No. 8—γ P-METHOXY PHENYL ALKYL γ BUTYROLACTONES



Compound	On earthworms	On fish
No. 1. R = CH_3	S = 10 Skin attacked D = 30	D = 15
No. 2. R = C_2H_5	S = 15 D = 120	D = 15
No. 3. R = nC_4H_9	S = 15 D = 120	D = 25
No. 4. R = iso-C_5H_{11}	S = 60 D = 180	D = 35
No. 5. R = p-CH_3O-C_6H_4	No depression	No death

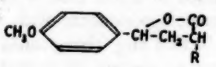
In this Table are described γ p-methoxy phenyl γ alkyl γbutyrolactones. The lower members of this series are very toxic. The compounds containing methyl group as substituent attacked the skin while ethyl and butyl group as substituent are active and at the same time do not attack the skin.

TABLE No. 9—γ PHENYL γ ALKYL γ BUTYROLACTONES



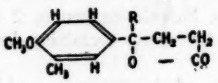
Compounds	On earthworms	On fish
No. 1. R = CH_3	S = 10 Skin attacked D = 60	D = 10
No. 2. R = C_2H_5	S = 10 D = 60	D = 15
No. 3. R = nC_3H_7	S = 10 D = 30	D = 15
No. 4. R = iso-C_4H_9	S = 10 D = 60	D = 20
No. 5. R = C_6H_5	S = 35 D = 120	No death

TABLE No. 10—γ P-METHOXY PHENYL α ALKYL γ BUTYROLACTONES



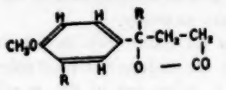
Lactone	Cocentration 0·01%	0·02%	Santonin 0·02%
No. 1. R = CH_3	S 60	50	S=30, D=120
No. 2. R = C_2H_5	S 45 No death in 3 hours	30	„ „
No. 3. R = C_3H_7	S 45 No death in 3 hours	30	„ „
No. 4. R = iso-C_5H_{11}	S 50 No death in 3 hours	40	„ „
No. 5. R = C_6H_{13}	S 50 No death in 3 hours	40	„ „
No. 6. R = $C_{14}H_{29}$	Active No death	Active	„ „
No. 7. R = $C_{16}H_{33}$	Active No death	Active	„ „

TABLE No. 11—γ 4-METHOXY-3-METHYL PHENYL α ALKYL BUTYROLACTONES



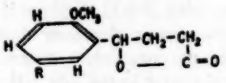
Lactone	Concentration 0·01%	0·02%	Santonin 0·02%
No. 1. R = C_2H_5	S 120 No death in 3 hours	70	S=30, D=120
No. 2. R = C_3H_7	S 40 D 240	20 130	„ „

TABLE No. 12—γ 4-METHOXY 3-METHYL PHENYL γ ALKYL γ BUTYROLACTONES



Lactone	*Concentration* 0·01%	0·02%	*Santonin* 0·02%
No. 1. R = CH_3	S 20	10	S=30, D=120
	D 90	60	
No. 2. R = C_2H_5	S 20	15	" "
	D 100	60	
No. 3. R = nC_3H_7	S 40	30	" "
	D (Two died in 3 hours	120	
No. 4. R = nC_4H_9	S 30	20	" "
	D 90	90	

TABLE No. 13—γ 2-METHOXY 5-ALKYL PHENYL γ BUTYROLACTONES



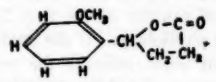
Lactone	*Concentration* 0·01%	0·02%	*Santonin* 0·02%
No. 1. R = C_2H_5	S 40	30	S=30; D=120
	No death in 3 hours		
No. 2. R = C_4H_9	S 25	20	" "
	D 125	60	

(1) In Tables 10, 11, 12 p-methoxy phenyl α alkyl γ butyrolactones and γ p-methoxy 3-methyl phenyl α alkyl γ butyrolactones have been described. In this series also it is seen that the toxicity increases till the alkyl group contains three carbon atoms. On increasing the number of carbon atoms in the -alkyl group to C_5 or C_6, the activity falls again. If the chain is increased still further, to C_{14}, C_{16}, etc., the lactones are not toxic at all probably due to the insolubility of the substances.

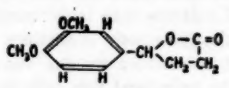
(2) Lactones containing the alkyl group on the α carbon atom are less toxic than those containing the alkyl group on the γ carbon atoms.

(3) In Table No. 13 are given γ 2. methoxy 5-alkyl phenyl γ butyrolactones. In these also the butyl substituted lactone is more active than the ethyl substituted one.

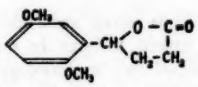
TABLE No. 14—MISCELLANEOUS BUTYROLACTONES



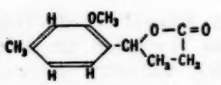
No. 1



No. 2



No. 3



No. 4

Compound	*On earthworms*	*On fish*
No. 1.	S = 20 Skin attacked D = 75	D = 15
No. 2.	S = 20 D = 90	D = 20
No. 3.	S = 15 D = 75	D = 30
No. 4.	S = 10 D = 30	D = 10

In this series of compounds the substituents in the benzene ring have been varied. No. 1 attacks the skin while the remaining lactones are more toxic than santonin and do not attack the skin.

From the foregoing results the following conclusions can be drawn:—

(1) The butyrolactone structure plays an important part in giving toxic properties to the substance. (2) progressive increase in the number of carbon atoms of the substituents upto 3-4 carbon atoms does not deactivate the substance but further increase markedly diminishes their toxicity. (3) The free phenolic group in the benzene ring is responsible for the increasing toxicity to a very high extent.

CONCLUSIONS

The santonin analogues (Table No. 1) are not as effective drugs. The 7 keto 8-10 dialkyl $\triangle$ 5-6. 8-9, hexahydronaphthalenes are not stable substances and therefore cannot be preserved in the pure condition. The simple dienones (Table 3) are comparatively more stable and cheap also. They are likely to prove to be good anthelmintics. The lactones similar to desmotroposantonin are inactive on fish and are also found to attack the skin of the worms and so are likely to be very toxic to the host and hence not very likely to prove as good anthelmintics.

In the butyrolactone series the higher homologues are inactive (probably due to their sparing solubility with increased molecular weight). In Table 6, the lactones attacked the skin and so are not so useful as good drugs. In Table 7, the lower homologues attacked the skin, as do the lower homologues of lactones in Tables 8 and 9. They are likely to attack the cell walls of intestines of the host and so cannot be used as drugs.

Lactones Nos. 2, 3 and 4 (Table 9), lactones Nos. 2 and 3 (Table 8), 2 and 4 (Table 14) are worth further investigation.

We take this opportunity to record our grateful thanks to Prof. A. S. Paranjpe of the G. S. Medical College, Bombay, for useful suggestions in the course of the work.

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PROBLEM OF MEDICAL EDUCATION IN INDIA

B. N. GHOSH, M.B.E., F.R.F.P.S. (GLAS.), L.M. (DUB.), F.S.M.F. (BENGAL), F.R.S. (EDIN.).

Carmichael Medical College, Calcutta.

It has been my experience as one who had occasion to come in contact with the students during the different professional examinations of various Universities either as an Examiner or as an Inspector of the Medical Council of India, to find a lack of practical training which is required of them. Medicine is pre-eminently a practical science, and unless the practical side is developed, and unless the young men are taught to apply the knowledge obtained from books or lectures to practice, such knowledge has a very limited significance. Most of the students are deficient in practical training, wanting in self confidence, and have not developed the power of observation so important in medical training. The chief aim with the majority of the present day students is to get through the examinations, and this they do by cramming the different text-books or lecture notes, without having a clear conception of the subject. We may here consider where does the fault lie? Can it be said that the present generation of students is less intelligent; or can it be the result of defective training? At the present time when the admission into the different medical colleges is made in the majority of instances on the basis of qualification, it is surprising that the students, many of whom have a brilliant University record, should fare so badly in their medical studies. In this connection one should consider the fact of a student's having a brilliant University record in the general line does not necessarily mean a bright career in the medical studies. Quite a large number of students join the medical college not for any special aptitude for the profession but because they fail to find a suitable vocation, or the vocation apparently appears more profitable. The majority of the students do not follow intelligently the lectures given to them in the class or bedside. Whether this can be attributed to fault in the preliminary training, or the language in which the lectures are given, demands very careful study, but the fact remains that the majority of students do not understand the subjects they are taught, and therefore, simply commit the different books to memory to get through their examination.

The question of medical education in India will have to be generally revised in the near future; therefore, an attempt to discuss the subject will not be out of place. It necessarily requires very careful and thoughtful consideration of the different questions which are intimately related to it. It will, therefore, be convenient to discuss the subject in the different bearings specially in relation to the following, viz.

1. Premedical. 2. Preclinical. 3. Clinical. 4. Postclinical or Postgraduate. 5. Research. 6. General observation.

1. *Premedical*—Under the present regulations a student can get his admission into a medical college after passing the I.Sc. Examination of a University. The subjects required are Physics (including Biophysics), Chemistry and Biology. Mathematics was included before but has been omitted. The syllabus, which has been prescribed in the different subjects is not well suited to medical education. Many portions may easily be omitted and such matters should be introduced which will be found to be of more practical value to the students in their future studies. The same remark applies to the present syllabus of Biology which should be so prepared as will be of more practical use to the students in their future studies in a medical college. It has been found that when the students attend the anatomy class they have very poor knowledge on mammalian structures. Greater stress should, therefore, be given to the teaching of biology to enable them to take an intelligent interest in the study of human anatomy.

There is again no uniformity in the subjects taught for premedical I.Sc. in the different Universities, e.g. in Calcutta organic chemistry is taken up in the preclinical course with anatomy, physiology and elementary pharmacology. It will be seen later that subjects for preclinical examinination at the end of 2nd year of medical study are many and the students are overburdened with too many subjects which they cannot properly assimilate within the period of two years.

2. *Preclinical Course.*—At present this includes anatomy with dissection of the whole body, physiology including chemical physiology, histology and experimental physiology, elementary pharmacology including practical pharmacy and incompatibility and organic chemistry. In all these subjects the students are examined in written, oral and practical. It is, therefore, necessary that some relief should be given if possible. In some Universities in India organic chemistry does not form part of the examination in the preclinical course. This forms the subject in premedical course in the I.Sc. If this can be brought in line with other Universities much of the labour of the students will be minimised and the time can more profitably be spent in the study of the other subjects. The subject of pharmacology is taught in an elementary way, the idea is just to acquaint the student of the principles of drug action, incompatibility and dispensing so that they may be able to take an interest during their clinical period when the action of individual drugs with their practical application in disease is taught. Towards the end of 2nd year a few lectures are given on bacteriology and some demonstrations are given in the wards to show the effect of certain lesions on the heart, or on muscles, etc. and on clinical methods. It is further proposed to give a few lectures on psychology. It will be seen that the subjects included are too ambitious and experience has shown that the students cannot properly assimilate the diverse subjects within the period of two years; though actually the students get only 21 months for study. So far as could be gathered the time spent on these diverse subjects are wasted as these are taken at the end of the 2nd year when the students are busy preparing the different subjects for examination. It serves no useful purpose to burden the students with subjects which they do not understand nor do they take any interest. The result of all this has been large number of failures in the first M.B. examination chiefly in anatomy and physiology. If the students could concentrate on the important basic subjects the result will be better and they will be better equipped for the clinical period.

3. *Clinical period.*—This extends three academic years. During this period the students attend lectures in medicine, surgery, midwifery, hygiene, pathology, bacteriology, post mortem, pharmacology & therapeutics, medical jurisprudence, radiology, ear, nose, throat, eye, etc. Besides attending the lectures the students attend hospital wards either as clinical clerks or dressers. He has to conduct 20 maternity cases and should also attend dental out-patient department for one month during the time he attends either the surgical or medical indoor.

Before appearing for the final examination instruction on radiology is given and they have to attend venereal clinic.

It has been found very difficult in practice to fit in all the subjects for lecture and hospital work. In fact students hardly get any leisure during the day from 8 a.m. to 5 p.m. Where

professors are working on an honorary basis, as in some institutions, they do not like to visit the college twice, once for hospital works and again for class lecture and this necessitates fitting in lectures within certain hours thus giving no leisure to the students.

At the end of the fifth year the final examination is held which has been divided into two parts, part I includes medicine, pathology, hygiene, medical jurisprudence, pharmacology and therapeutics; and part II includes surgery including surgical pathology, ophthalmology, midwifery and gynaecology. In some Universities pharmacology and therapeutics only and in others hygiene, medical jurisprudence, and pathology are grouped as part I of the final examination and taken at the end of the 4th year. Medicine, surgery and midwifery and gynaecology form the subjects for the final year. Each system has its advantages and disadvantages.

The curriculum includes too many subjects as well as too much materials and it will be found that one specialty after another has been split off, e.g. ear, nose, throat, radiology and erected into professorship, made a subject of special teaching and finally won a place in the examination list. It is well to remember in this connection the remarks of Abraham Flexner "The medical curriculum cannot aim to produce physician ready for practice. It can at best so train students that practical experience in the first instance as intern will in time mature and equip them."

It is unfortunate that more and more is being demanded of the student and no one appears to give serious thought to assessing the burden he can reasonably be expected to bear, but each branch of medicine cherishes the fond hope that some other branch will be ready to sacrifice.

Medical teaching.—The standard of efficiency of an institution and its products depend largely on the quality of the staff responsible for teaching from the professor downwards. It is, therefore, of first importance that the teachers should be properly selected and must possess certain qualities which will inspire the confidence of the students. He should be an expert on the subject he professes to teach, should be able to devote sufficient time with the students and must have a spirit of research in his own line. A medical man with large practice is not necessarily a good teacher. Since teaching is an art and comes naturally to some, special care should be taken to select men possessing teaching capacity. Therefore, every effort should be made to select the right type of man. It should be the aim of every institution to encourage young men to do postgraduate work and research, so that with this background a young man may aspire in time for the highest appointment. It is a debatable question whether a teacher or a professor should be a whole time man and should be engaged in private practice. But the ideal should be to get whole time men whose only work will be for the interest of the students. Experience has shown that honorary workers both in the hospital and in the college cannot devote that amount of time and attention which is required of them. I will have more to say on this later.

Research in every department should be considered obligatory for every teacher so as to infuse a research spirit into the students.

At present more attention is paid to theoretical teachings and laboratory findings than on clinical findings. Clinical teaching in the wards is often more of the nature of a didactic lecture which makes no impression on the students than a practical demonstration on a particular case.

In a country like India, where facilities like laboratory and other aids to diagnosis are not always available except in a few large towns or cities and even where such facilities are available they are beyond the means of the bulk of the people, it is necessary that the students should get a more thorough and sound training in clinical diagnosis which unfortunately is sadly lacking in modern teaching. This is possible only when the number of beds in the different teaching hospitals is increased and the type of cases is based on students' requirements. It should be compulsory to spend more time at the bedside, both the student and the teacher, than in the class room or a laboratory. While every effort should be made in teaching scientific method of approach there is no justification in neglecting or laying less emphasis on the clinical methods of examination.

Examination.—It is necessary to impress that the method of examination reflects to a large extent on the method of teaching undertaken in the classes. Improvement in teaching can only serve a useful purpose if the examination is also done from the same point of view. The examiners should be careful in putting questions in such a manner as will stimulate students to study the subject in an intelligent way. The present system of examination leaves much to be desired and the fact that a large number of students fail in one subject than another shows that either the teaching in that subject is in the wrong direction or the examiners demand from the students more than they are expected to know in a qualifying examination or that the students neglect their subjects. It is possible that all these factors are responsible for the present state of affairs. It is a common knowledge that certain examiners expect too much from the stulents and that the examination is conducted in a way which is different from the way the students are taught. It is necessary that the external examiners should be appointed from other Universities; in fact it should be the principle, so that the standard of examination in all the Universities may be more or less uniform.

To maintain uniformity of standard and to avoid injustice to the students it is desirable that the University should appoint an assessor in all examinations, as is done in F.R.C.S. examination.

Postclinical.—The present regulation enjoins that after the student passes the final examination he should work as an intern for a period of six months before he will be eligible to receive his certificate to practise. Whether six months' work is sufficient for the purpose is a debatable point. However, since this has not yet been given effect (under the new regulation the final examination has not taken place yet) the question of providing these successful students proper facilities for post clinical work has got to be thought out so that the students may get the maximum of practical benefit during this period and that the spirit of the regulation is properly fulfilled.

A student may work under a physician in a medical ward, under a surgeon in a surgical ward or in gynæcological, eye etc. or may work in a laboratory for pathology or bacteriology or pharmacology. How this system will work to the greatest benefit to the student it is not possible to visualise now.

Post-graduate teaching.—At present several postgraduate degrees and diplomas are offered by the University, M.D., M.O., M.S., D.P.H. etc. Except for D.P.H. and D.T.M. there is no arrangement now for giving guidance or training in any other subjects and the candidates make the best use of the meagre opportunities which they can find. This limits the sphere to only those who may be fortunate enough to work in a hospital

as house surgeons or house physicians or in some laboratories. For a medical man who is not attached to any of the colleges or hospitals it is almost impossible for him to get the necessary facilities, training, etc. to equip himself for any of these higher examinations.

Some Universities in India also offer special degrees or diplomas in ophthalmology, radiology, psychiatry and M.D. in pharmacology. All Universities should make the necessary arrangements to enable a suitable candidate to specialise in all these subjects in India without going abroad. To stimulate research, Ph.D. degree should be introduced in subjects like, bacteriology, pharmacology and physiology, etc.

Refresher Course.—At present there is no arrangement for this and a medical man who is not attached to a teaching institution very soon finds himself in a most unenvious position having lost all contact with current advances. Every arrangement should be made to give a refresher course in every teaching institution. To get the maximum benefit these men should work for at least six months as house staff under the direction of the visiting surgeon or physician.

University Professor.—The University should create chairs in different scientific subjects where students and practitioners can attend and get the benefit of modern advances in different branches of medicine. The University Professor must be the best man available in that particular subject and should have research work to his credit and should undertake research and establish a school in that subject. These should be paid appointments and in no case honorary.

Research.—It has been mentioned before that research should be obligatory for a professor and that the student should have the inspiration of research spirit during his college career. Unfortunately, as things are at present this ideal is not possible and real medical research is a rare commodity in most of the educational institutions. Research is at present confined to some Central and Provincial Research Institutions under Government control. In most teaching institutions research is done at spare hours eked out from teaching works and therefore perforce perfunctory. Even then it is noteworthy that valuable contributions have been made in this direction. Research can be directed in many directions; to name only a few, epidemiology and statistics; pharmacology with special reference to indigenous drugs; malaria; tuberculosis; nutrition and clinical.

The present state of affairs can only be improved if the Government, the Universities, the public and the different industrial organisations co-operate in this direction. Proper enquiry on any of the above problems requires a well organised committee, sufficient money, and right type of men under whose guidance the different workers can undertake specific enquiry.

At present the Central Government controls medical research through the Indian Research Fund Association under the Chairmanship of D.G. I.M.S. This body as at present constituted is represented mostly by Officials with only two or three representatives of the Indian Universities. Naturally private institutions or individuals capable of undertaking research in any branch have very little opportunity of getting much financial assistance. The whole machinery requires readjustment and a body on the lines of the National Research Council of England should be set up. This body should as far as possible be a representative one, consisting representatives of all the Universities having a medical faculty, representatives of the different medical colleges, both official an non-official, Indian Science Congress Association and also representatives of different scientific societies, like the National Institute of Science, the National Academy of Science, etc. This parent body should be divided into Sectional Councils. Schemes for research on different branches should be invited from all institutions and these when scrutinised should be distributed to different institutions or individuals capable of undertaking the work. It is also desirable that the Council, should, as occasion arises, invite a particular institution or research worker to undertake special research on some specific problem.

The different Universities have so far made little progress in stimulating medical research. Every University should form a Board of Scientific Research and should have a definite plan of subjects requiring investigation and should approach the different medical institutions to undertake these works and give liberal financial assistance for such work. This scheme can only be successful on two conditions, namely, sufficient financial help, and proper advisory body consisting of actual workers who have some research to their credit. I am certain that workers are not lacking, what is wanted is proper guidance and organisation. The workers must be sufficiently paid to recruit as far as possible the best type of men. It is a mistake to think as I have often heard being argued, that a medical man with a spirit of research will work under any condition. In these days where the struggle for existence is so hard and competition great, one should not expect young men to devote their whole time and energy on a pittance. And to my mind this is one of the reasons why we are backward in this work. Unless we make the different research posts well remunerative we shall remain where we are.

Apart from the Government and the Universities much help in this direction can be given if the different industrial organisations engaged in drug manufacture take some interest in this direction. The health of the industrial workers in different industries requires careful study and research on the basis of western countries. New problems have been introduced largely through the development of new industries and the invention of new processes. There is ample field for work and each special industry calls for special care and attention. There should be organised attempt to solve the different problems for the health and welfare of the workers. Therefore different industrial organisations can or rather should help by making sufficient grant for specific enquiry. Further, there are many well organised and successful drug manufacturing concerns all over India. If they only ear-mark a definite sum annually for research I am confident much progress can be made in this direction. Let them take up some particular drugs and approach some of the local medical institutions to undertake a thorough investigation on the action, chemical composition, etc., of such drugs and bear all the expenses relating to such investigation. This will not only help them in placing before the medical profession a really good product but will incidentally stimulate research. After all an investigation made in a recognised laboratory will be of greater value than one done by themselves, if done at all. Research workers do not manufacture drugs or preparation, it is the manufacturer who derive the benefit and why should not the manufacturers come forward and help research in more scientific and thorough manner. Since the work on Punernava, Rauwolfia, Kut, Asoka, Kurchi have been done, it is the manufacturers that have benefitted and not the research workers.

I am not one of those who think that research can only come from the West or from the Government institutions.

We have plenty of capable young men and given the financial help and opportunity it will be possible to establish a real band of workers who will be a glory to the country.

General observations.—Before bringing this paper to a close I wish to make a few observations on medical education generally. I have already mentioned that the student is overburdened with too many subjects which they can hardly assimilate. It is, therefore, necessary that there should be well thought-out pruning of the range and amount of factual knowledge we expect of the student. As Dr. E. M. R. Walshe puts it "We cannot rationally expect that the newly qualified doctor shall be the complete obstetrician, pædiatrician, psychologist, orthopædist, and expert in hygiene and social medicine." In prescribing the curriculum we have been following, or rather imitating, the one prescribed by the General Medical Council of Great Britain, without regard to the practical adaptibility in this country. It may be interesting to note the observations of Dr. Walshe on the introduction of psychology in the medical curriculum which I have already mentioned, "the content of both normal and clinical psychology is highly charged with controversial matter: conflicting hypotheses compete for recognition as generalizations of the facts of observation, and these 'facts' are not always clearly distinguishable from assumptions. Psychology is in a ferment, and we must not plunge the student into the fermenting-vat. The exponents of this field of medcine must first put it in order and lend it coherence before psychological medicine can hope—or ask—to take its proper place in medical education." Whereas the student is being overburdened with such diverse subjects, it is regrettable that proper clinical teaching and the outlook of the students on clinical facts are being sacrificed. Therapeutics, for instance, is hardly taught, and the study of pharmacology and applied therapeutics is neglected in the present curriculum and has been relegated as a minor subject. The result of ignorance of pharmacology and therapeutics is the indiscriminate use of almost every product of chemical ingenuity in modern practice.

The present system of teaching pharmacology as detached from therapeutics is wrong in principle and has been pointed out by me in my various reports on the subject to the Indian Medical Council and also through the British Medical Journal (1937). But nothing has been done to improve it. The same may be said of many other subjects. In England and America attempts are being made by those interested in medical education to cut down anatomy within reasonable limits without sacrificing anything important. One finds no such effort being made in this country. On the contrary the subject is being burdened with more and more facts which the students find almost impossible to assimilate within the period of two academic years. None of those who are responsible for teaching ever made any serious attempt in this direction. They should meet together and see if anything can be done to reduce the burden of the students without sacrificing any legitimate portion. I am sure before long we will hear some solution in Western Countries and then we will only follow their directions. The real trouble is that we do not give that much time, thought and attention which is required of us and expect others to do that part of thinking and make things easy for us only to copy.

Teaching of hygiene and preventive medicine leaves much room for improvement. At present this is confined to a few lectures and perhaps a few demonstrations on the working of septic tanks, trenching ground, filtration of water, house drain, etc. No attempt is made to treat the subject on a broad basis according to modern trends where hygiene or preventive medicine constitutes only a part of the wider problem included under what is now designated as social medicine. This envisages an appreciation that illness or debility states without physical signs and, indeed, many organic diseases have discoverable origins in social, domestic, or industrial maladjustment, in fatigue, economic insecurity, or dietary insufficiency, with a view to lowering the incidence of preventable diseases and, what is more, to raise the general level of human fitness. The subject is, however, far too big and important to admit of further discussion in this paper.

Situated as we are, there is no organised effort to improve medical education and medical research. Any improvement presupposes that we should face facts and rectify our defects. Unfortunately we are reluctant to acknowledge our deficiencies and shortcomings. We all suffer hopelessly from lethargy, lack of initiative and creative instinct. It is not possible to anticipate what will be the findings of the Bhore Committee or the recommendations of the six medical men who have been invited by the Government of India to advise the Committee. Their recommendations can only be on general principles. Defects in teaching, defects in the carriculum and other details discussed in this paper can only be rectified by the different educational institutions and Universities responsible for the carrying out of the recommendations. The visits of the six members of the mission are far too short to form any clear idea regarding the actual state of affairs or working. As always happens there is good deal of window dressing to show something which actually does not exist. If we want real improvement and progress we should face unpleasant criticisms and then only real improvement can be achieved.

Being the supreme controlling body for medical education in India, the responsibility of the Medical Council of India is great and it is the duty of the Council to regularise and improve medical education in India. The Medical Council should appoint an *ad hoc* committee of experts consisting of teachers in anatomy, physiology, pharmacology, medicine, surgery and midwifery with wide powers to visit different educational centres in India and to find out the defects in the present system of medical education in all its aspects and then submit a report suitable to our country.

Reform in medical education is overdue but even then what is of greater importance is proper administration of the inner working which unfortunately is sadly lacking.

With the establishment of the Medical Council of India the maintenance of a uniform curriculum suited to our students, uniform standard of teaching and examination is vested on this body. Although regular inspection is done through their different inspectors, it has not been possible to enforce a uniform standard both with regard to teaching, examination and curriculum. For instance organic chemistry does not form a subject in the pre-clinical period in all the Universities. Whereas elementary pharmacology and pharmacy form the subject of examination at the Calcutta and Patna in the First M.B. examination, pharmacology and materia medica form the subject of examination at the end of the fourth year in other Universities. Ophthalmology forms a separate subject for examination in some Universities but not in all. The Medical Council directs that all examiners should be appointed from amongst those who is a teacher or who had recently been a teacher. In practice, however, one finds men who had never been a teacher or connected with any educational institution been appointed

examiners. It is desirable that external examiners should be selected from other Universities. This is rarely done in all the Universities. This if followed will enable the different examiners to standardise both teaching and examination and enable the different teachers to have a knowledge regarding the method of teaching, equipment and standard of examination done in other universities, so that teaching and examination could be improved and modified as the case may be. The Medical Council should see that the rules they have framed are strictly observed.

Honorary Staff.—I wish to be pardoned if I make a few observation on the advisability of appointing honorary men in teaching institutions as professors, lecturers, or as physicians and surgeons both in the Government and private institutions. Much can be said both for and against this practice. There is no doubt of the fact that the honorary men have been doing much valuable work or the Government would not have taken advantage of their services. Since their services are maintained there is no doubt that there is work for such men and in the absence of these honorary men Government would be required to appoint paid men to carry on the work now being done by these men. It is not fair that the Government should exploit them on the plea that these men being attached to the different hospitals are gaining experience and incidentally making good the financial loss by private practice by virtue of their position. In private institutions, however, the position is slightly different. Their funds are small and limited and they cannot afford to pay any remuneration to the senior members of the staff. Imparting medical education and giving medical relief is the primary duty of any Government and municipality. Therefore, to contribute only a nominal sum annually to these private institutions is inexcusable. Both the Government and the municipality should come forward with more grants to enable the private institutions to pay at least a decent sum to the teachers.

While acknowledging the good work that is being done by the honorary men in the different official and non-official institutions it must be said that in all fairness they should be paid for their work. After all they are all professional men and they have to earn a living, consequently the amount of time and labour necessary cannot be given if they have to find other means for earning money. One cannot, therefore, enforce strict attendance on these men. Moreover, most of these men are attached to more than one institutions, and it has been found in practice that the work of clinical teaching is being done by the different understudies. These young men though well-qualified, their teaching is mostly theoretical than practical and real clinical teaching in every department is neglected.

There are other problems of medical education not fully discussed in this paper, *e.g.*, the type of general education best suited for medical education, the status and categories of teachers we need, and the necessity of drastic reform of the present system of vocational examination.

Dual Standard.—In India there exists a dual form of medical standard. The medical schools turning out licentiates with lower standard of training completed in four years and medical graduates from the Universities with a higher standard of training. The licentiate class had to be introduced in India as in many other countries chiefly for economic reasons. The lower standard of medical education has been abolished in Madras, all the medical institutions having been brought up to the University standard. It is desirable that all medical institutions should have a standard of teaching and examination satisfying the minimum requirements of the Medical Council of India. With the exception of Russia no other country retains this dual standard of medical training. And Russia is fast trying to obtain a uniform standard of medical education. The necessity of having more medical men will be appreciated if we compare the number of medical men in India with other western countries. It will be seen that Britain with a population of 50 millions has 61,420 doctors; America 150,000 in a population of 130 millions; Russia with a population of 180 millions has 120,000; and India with a population of 388 millions has only 42,000 doctors. If we take the ideal as one medical man for every 1,000 of the population, India will have to produce yet at least ten times the present number. The question which all of us has to face is how this could be possible. Let me first see how this was attained in Russia. In 1914 Russia had only 25,000 doctors, mostly of the licentiate class, the proportion being 3 to 1 of graduate. After the last great war this number was still more reduced. But by proper planning, which began in 1925 the number has increased in 1940 to 120,000. This was possible by increasing the number of students in each medical institute and introducing the system of training in batches. Thus at the Leningrad First Medical Institute there were in 1938 about 3,000 students including a new admission of 900 fresh students. Although the hospital had only 1,200 beds the students had access to about 1,000 more beds in hospitals in other parts of the city. The result had been that four times the normal number of students got their training in a system of shifts as in a factory.

This system can with profit be adopted in India and the question of utilising the large clinical materials in non-teaching hospitals may well be considered if we are earnest in turning out larger number of medical men.

The necessity is there, the materials are there and I am sure there is no dearth of qualified men to undertake the work of teaching. All that is wanted is a well thought out planning so that one can give effect to the scheme to the greatest advantage to the country.

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SOME OBSERVATIONS ON ETIOLOGY AND PATHOLOGY OF NEISSERIASIS (N. GONORRHOEAE INFECTION)

Its Symptomatology Relevent to Systemic and Urogenital Syndrome

K. K. CHATTERJI, M.B.E., F.R.C.S.I., LT.COL., I.T.F.
Honorary Consulting Venereologist, Chittaranjan Hospital, Calcutta.

(*Continued from previous issue*)

Some Surgical and Diagnostic Features

A didactic description of symptomatology and diagnosis would perhaps be a misfit here. It would, however, be appropriate to deal with such relevant items as are essential for diagnosis and follow-up of obscure conditions.

Infection and its incubation period. The following investigations are necessary:—

(1) The dates of the last exposure and previous ones, if any. (2) The nature of exposure; for instance, if there was just one coitus or more than that at the same exposure. (3) Was the exposure during incubation period. (4) Coitus while under the influence of alcohol or other intoxicants. (5) Previous history of gonorrhœa and treatment. (6) Conduct of life following the infection; food and beverage, alcoholic or otherwise, sexual excitement, physical exercise and strain, etc.

An otherwise uncomplicated infection acquired at a single exposure without too generous use of prophylactics and self-treatment gives a reasonably good clinical, diagnostic and prognostic outlook. Injudicious use of prophylactics and urethral injections particularly of strong antiseptics would have direct or remote undesirable consequences.

Case Report 21: A nice young lad after seeing a suggestive cinema film succumbed to the solicitations of an undesirable female fellow-spectator at the show. They got rather intimate and he felt his 'wind up' after his first sex adventure, speedily obtained some potassium permanganate crystals and in his anxiety overdid himself with a strong solution. This resulted in considerable irritation of his external genitals and congestion and œdema of the urethra. Dysuria and hæmaturia followed, with inflammation and erosions of the glans and prepuce. After days of suffering and further self-treatment, he saw a doctor who in view of the ulcerations and associated inguinal lymphadenitis, forthwith commenced N.A.B. injections on a syphilitic hypothesis, naturally without any amelioration of his sufferings. When he consulted us, there was marked erosive balanoposthitis with phimosis, and inflammation of the whole penis; though he micturated with some strain, it was not very painful. The septic condition indicated sulphonamides which gave him relief. There was a mild type of urethritis; no gonococcus microscopically or culturally; apparently a case of chemical urethritis. Flow of urine not good; urethroscope revealed a small, hard fibrous stricture in mid-anterior urethra which was divided by the internal urethrotome and dilated on a few occasions.

The following case is perhaps a little out of place here but interesting.

Case Report 22: A young patient consulted for a chronic type of urethral discharge, without any history of exposure. Laboratory reports were negative for gonococci. He also complained of difficulty in micturition. A few days of lavage and autogenous vaccine stopped the discharge. On urethroscopy: Small elevations on the urethral mucosa with free margins. These were snipped off through an endoscope and the site electro-cauterised. This gave him relief for some years. History: he had difficulty in passing urine from his early boyhood and got into the habit of introducing stone slate pencils into his urethra which helped him to pass urine; evidently, the infection was carried by this means. He consulted years later as an adult with symptoms of upper urinary tract involvement.

Incubation period is an important item as a differential diagnostic point. If there have been multiple exposures, syphilitic infection has to be eliminated and dual infection (treponemal and neisserian) has also to be borne in mind. The following case is interesting.

Case Report 23: A middle-aged zeminder consulted his physician for urethral discharge. On the strength of the date of latest exposure and positive slide report, he diagnosed it as a case of gonorrhœa and treated him accordingly; though symptoms partly abated, a slight discharge and some discomfort in passing urine persisted. When he consulted I felt a small hard lump on palpating a little beyond the navicular fossa and on examining an urethral smear, many R.B.C. were seen. An intra-urethral chancre was suspected; on obtaining positive serum tests, N.A.B. and bismuth injections were given to which the case readily responded.

The co-existence of neisserian infection with soft chancre, Vincent infection and venereal granulomata will occasionally be seen. Phimosis is a common complication in these cases and urethral lavages are difficult and inadvisable. Chemotherapy is indicated which often facilitates preputial reflection by reducing œdema and healing ulcers. This, if followed by electro-dessication, renders the ground suitable for local urethro-therapy.

In cases of repeated coitus, a second exposure and infection during incubation period, the symptoms are more severe, particularly if there is a history of alcoholic indulgence. In these cases the urethra is more receptive and the organisms find access to the deeper parts giving rise to posterior urethritis and complications. Multiple coitus at a single exposure is liable to set up spasms and irregular peristalsis and if the organisms reach the openings of the vesicular ducts, it is liable to be readily carried up these channels to the vesicles and set up vesiculitis, vasitis and even epididymitis and not infrequently prostatitis. The following is rather an interesting incident.

Case Report 24: It happened during a festive week and three people were involved, one rather elderly and the other two youngish; all three were under alcoholic influence and were entertained by the same female transmitter of infection. The elderly one got a severe type of anteroposterior infection; he admitted that he suffered from ejaculatio præcox and had two 'goes'; one of the young friends who had a short 'go' as he was too drunk, escaped with a mild type of anterior urethritis and a short course of treatment rendered him free. The third lad never developed any symptoms and remained clinically and bacteriologically free; this can perhaps be explained by the type of epithelial lining of the urethra which gives partial local immunity.

This last item, namely the character of the epithelial covering of the urethral mucosa which either resists or facilitates implantation of the specific diplococci and secondary organisms would naturally affect the incubation period. This fact may mislead us to surmise a case of urethritis to be of nonspecific origin and later to our chagrin we find the characteristic 'diplos' at a later stage of examination. Thus clinically,

a seemingly simple urethritis may slowly or even suddenly present the unerring neisserian syndrome. Here are two illustrative cases.

Case Report 25: A senior army officer had a mild urethral irritation without any discharge about 15 years previous to the present encounter which had subsided readily with symptomatic treatment. The present attack, a typical neisserian urethritis, appeared most inopportunely in view of his service conditions, three weeks after the last contact with a party with whom he had been having frequent sex relations for several months. There were no signs or symptoms for three weeks and all the treatment he has had was some sulphanilamide and stock vaccines. Examination: profuse urethral discharge, gonococcus and streptococcus on slide examination. A few anterior lavages reduced the discharge to almost nil; on stripping posterior urethra and Cowper's glands, a quantity of purulent discharge was obtained showing gonococci on examination. After deep antero-posterior lavage for a few days, profuse purulent fluid was obtained on prostatic massage. In this case, apparently, the posterior urethral involvement was prompter and prior to that of the anterior urethra and can perhaps be explained by favourable epithelial disposition.

Case Report 26: A military officer. The initial symptoms appared about six days after exposure. Intensive treatment; clinically and microscopically free. Exposes again; symptoms in acute form appeared on the third day. In this case his anterior urethral mucosa was evidently more receptive.

Cases of prolonged incubation with a tardy appearance of initial signs in patients who have used local prophylactics or chemotherapy are common in our experience.

Case Report 27: A science student (chemistry) had his first exposure. He had heard of sulphanilamides and took some tablets without any local treatment. He developed some irritation and discharge in about six weeks. Smear and urine culture negative; culture of urethroprostatic fluid positive.

A discrepancy between urine and urethral or prostatic fluid cultures is not an unusual condition after use of urinary antiseptics. The sulphanilamide group often renders urine negative though the urethral mucosa and glands still retain the organisms and cultures may be obtained from these by massage or negative suction.

The discharge. The most disconcerting and distressing feature of gonorrhœa from the patient's point of view is the discharge; his obsessive anxiety is to stop it and his immediate urge to the physican is 'stop the discharge, the cure can follow'. The worst of it is that the cessation of discharge gives him a false sense of security; he slackens off, his calls at the clinic become infrequent and he ignores restrictions. Gonorrhœa commences as an urethritis followed by a tissue diarrhœa or urethrorrhœa, an outflow of fluid containing cell elements, organisms, etc. We shall here consider the discharge from clinical and diagnostic points of view.

I. The Fluid Elements—The outpouring fluid consists of the products of reflexly induced glandular activity, exuded blood serum from congested capillaries, cytolized cell elements and intercellular cement substance. Incidentally, it helps to flush out the passage and thus retard lodgment of organisms and absorption of toxins. It does not, however, possess bacteriostatic value as gonococci grow *in vitro* in the presence of this fluid, nor does it wash out the deeper lying gonococci; the application of negative pressure in suitable cases, however, may be helpful in drawing these to the surface to facilitate their final disposal.

Case Report 28: A case of urethritis consults his personal physician who was of opinion that hypertonic salt solutions were beneficial for gonorrhœa. There was no definite history of that infection; lavage with such solutions rendered the discharge persistently profuse and he consulted us. On the first appearance of the discharge, he had used injections of some substance obtained from a Kaviraj. This led us to think of chemical urethritis. Rest and mild astringent instillations cured the condition.

Case Report 29: The same physician prescribed chemotherapy and hypertonic solutions for a case of confirmed gonococcal urethritis. This led to profuse urethrorrhœa. On consulting us, examination disclosed the usual extra and intracellular gonococci and other elements. Autogenous vaccine and chemotherapy with antiseptic lavages reduced the discharge to some extent but the application of negative pressure (Alport) reduced it substantially.

Hypertonic solutions are supposed to stimulate tissues and mucosal glands to physiological activity but this may be overdone. The more their energy is expended on 'hyperphysiology' the less of it will be left for protective purposes.

II. Cell Elements—Some observations on the significance of cell elements and organisms obtained by milking, stripping or massage and suction of the glands and genito-urinary tracts will be made.

Technique for collecting material for smear and cultural examinations:

Time—morning, before passing urine.

For anterior urethra: 1. Take 'morning drip', if any. 2. Clean glans, meatal opening and prepuce by washing with cotton wool and antiseptic solutions—take a swab-smear from meatus up to navicular fossa. 3. Strip urethra by milking. 4. Strip urethra on a straight metal bougie. Collect materials for slide and culture and then 5. Inject 4 per cent novocaine solution and introduce straight endoscope (size 24-26 F) and look for abnormalities such as folliculitis, littritis, pouting ducts, granulations, lymphocystic buds, millet-seed-bodies and punctate areas with pus or mucopus; collect by means of urethral scoops or swabs or by suction tubes.

For posterior urethra: wash out anterior urethra, preferably using a penile clamp and then in order, milk membranous urethra, massage Cowper's glands, the prostate and seminal vesicles and make separate collections. An anterior or full-length metal bougie may be used according to indications. Then instil novocaine solution and take an endoscopic view as for anterior urethra using a suction apparatus, if necessary.

In gonorrhœa, particularly in chronic cases, besides gonococci, there is an assortment of secondary organisms as the badly draining infected prostate, the vesicles or Cowper's glands may harbour one or more particular types of organisms. The gross cultural growths of urethral organisms may overshadow organisms from the prostate, etc. To obviate this, the patient is asked to urinate before prostatic and vesicular massage, but for apparent reasons, preliminary urethral lavage is preferable to the washing out by patient's own urine.

Though these varied methods for differential investigation are necessary in complicated cases, they are not unavoidable; some patients do not readily submit to diverse manipulations and their susceptibilities have to be respected. As has already been discussed, involvement of parts in close anatomical contiguity and functional relationship, is treated as a whole as the affection of one part is very seldom at the exclusion of the other. The 'finishing touches' at the concluding stages of

treatment might call for detailed investigation of individual structures for the cure of obscure symptoms and characteritically those relating to sex factors, potentia generendi, particularly before we give the patient a clean bill and 'marriage permit'.

In the conical glass, mucous 'floaters' are generally in suspension and become roapy on adding alkalies; the heavier shreds with pus and cell elements deposit at the bottom. Sometimes on acidulating the urine, thick and heavy ones become light due to the adhering phosphates being dissolved.

The surface cells are in the discharge but it so happens that the urethral glands and follicles may be permanently or intermittently plugged with desquamated materials. These have to be obtained by stripping, milking or suction and failing this by a preliminary use of the endotherm applicator.

The normal prostatic fluid is a pale bluish-gray material. Microscopically, there are numerous lecithin bodies, a few epithelial cells and occasional amyloid bodies (corpora amylacæ), and just a few W.B.C. If it turns out to be a 'dry' massage or there is a negative test, prostatic massage on three alternate days or a prostatic massage after prostatic endothermy or diathermy may meet with success. The presence of R.B.C. indicates acuteness or breaking down of granulations. The vesicular material is whitish, partly a homogenous gelatinous material and partly fluid; under the microscope a few spermatozoa may be seen. The relative number of lecithin bodies and W.B.C. and the presence of degenerated cells have respective significance. Pus cells may either float in the prostatic or vesicular fluid, or found entagled or incorporated in the cell elements, etc., these should be considered pathological, the latter more so than the free ones.

We see W.B.C., mostly polymorphs, free or with gonococci inclusions. Inspite of inclusion and phagocytic activity, phagocytic index, *i.e.*, the number of cells showing phagocytosis per 100 of free polymorphs, which was once considered to be a criterion of curative process, is now known to be of not much clinical value. The presence of eosinophiles is interesting but its clinical significance does not seem to have been ascertained yet. R.B.C. are rarely seen; they indicate acute types of infection possibly with secondary organisms, chemical or mechanical trauma or presence of an old stricture.

Leucocytic cytase does not seem to possess digestive properties for gonococci nor kill them; *in vitro* they keep growing whether they are intra or extra cellular; mechanical transportation of the extracellular gonococci from the mucosal surface to the deeper interepithelial spaces and submucosa seems to be the main function of phagocytes.

Epithelial cells are always present but polymorphs predominate at least in early stages; in later stages, epithelial cells increase in number; their presence in large numbers in the early stages signifies irritation, particularly by strong antiseptic solutions for irrigation and instillation or too frequent use of milder solutions. Therapeutically, therefore, the increase in the number of epithelial cells may be an indication for reducing the strength of the solution or changing the antiseptic for another one.

It is interesting to note that the presence of a large number of epithelial cells and a preponderance of the squamous type in non-specific urethritis might indicate stricture or the presence of varied secondary organisms, perhaps with phimosis or redundant prepuce. If in non-specific urethritis, there are microscopic exhibition of bacterial flora and a large number of epithelial cells, unnecessary trauma will be found to be the main cause. In a few cases an irritating vaginal secretion is the cause of an obscure, recurring urethral discharge with shedding of epithelium in the male partner.

Case Report 30: An elderly gentleman without any history of extra-marital exposure, felt disconcerted at the appearance of urethral discomfort and a discharge. On examination: pus and epithelial cells in fair number; organisms varied at different tests. Local treatment gave relief but the discharge would return. This puzzled us and the patient. On enquiry, the wife gave history of leucorrhœa and on examination: mucocutaneous erosions and a profuse discharge. Laboratory reports: diphtheroids, very few. The condition is was ascertained was due to the use of a particular contraceptive. General and local hygienic measures cured the wife's condition and the husband soon got over the trouble.

A detailed study of prostatic massage fluid is often of much clinical value for its readings cover slip preparations are recommended. Generally 1/6th inch field is taken as a standard; in this field:—(1) A normal secretion should not have more than 2 to 6 W.B.C.; an increase, with corresponding decrease in the other elements, is considered pathological, particularly if the W.B.C. show signs of degeneration. (2) The lecithin bodies are small round and refractile: size, from a minute point to about the diameter of R.B.C.; number varies in different individuals but they decrease in number as the number of pus cells increase and *vice versa, i.e.*, as lecithin bodies increase pus cells decrease; this seems to be a characteristic condition. With reference to these lecithin bodies, it must be remembered that while these are called prostatic granules, there are other granules, particularly in cases of chronic infected prostates, which are products of disintegrated purulent material from the prostate. (3) The presence of more than six degenerated cells or pus cells in the field indicates prostatic infection. If they are free cells, the prostatic drainage is fair; if the cells are in clumps, drainage is poor and the reduction in the number of clumped cells in the course of treatment indicates its efficacy.

Stained prostatic secretions present difficulties; as it is, the secretion is difficult to fix on a slide and when fixed and stained, the granules, the lecithin bodies and micro-organisms appear confusingly vague.

R.B.C. in the fluid may indicate a hidden subacute focus in the prostate, the vesicles or the urethra, breaking down of granulations or incipient T.B., particularly if it is in the vesicular fluid. The possibility of fibrotic changes in the prostate induced by syphilis or other causes resulting in 'dry' taps may as well be borne in mind. While a condition of prostato-vesiculitis associated with posterior urethritis has a general acceptance, Pelouze (1929), and others think that in all cases of posterior urethritis, vesiculitis is seen in 5 per cent cases whereas prostatitis in 90 per cent.

III. Micro-Organism—N. gonorrhœæ is the specific organism; six other neisserian type of organisms have been described, *viz.*, N. meningitidis, N. catarrhalis, N. pharyngisici, N. flava, N. gigantia and N. mimeæ. Fortunately the genitourinary tract is not an usual habitat of most of these. The presence of a few may be due to accidental infection of the tract or abnormal sexual contacts. Of course, a mixed infection with one of these and gonococci is not quite uncommon.

The identification of gonococci and their differentiation from other organisms which they mimic, particularly streptococcus moniliformis and the meningococcus are confusing. This applies to slide as well as culture tests and it would seem that our laboratory colleagues have a legitimate grievance about this. I would make a few observations as the

result of work in our Clinical Laboratory, supplemented by the study of literature, particularly contributions of the American Neisserian Medical Society. Due to uncertainties and confusions, various tests have been devised, such as C.F.T.(G.), (the gonococcus compliment fixation test), T.D.T. (thermal death time tests), fermentation tests and alkaline tests.

The temperature factor, that is the viability of gonococci in variable temperatures, seems to have been solved. We know now that they are extremely resistant to cold and can withstand a freezing temperature for 24 hours; as a matter of fact gonococci in suitably inoculated media is best transported on ice in a thermos container. Further, they maintain their viability in urine centrifuged at low speed, for 24 hours and the results are better still, if the urine is at pH 6·0 to 6·5.

I shall now briefly record our laboratory observations on some of the special features which characterise gonococci by staining and cultural methods, fermentation tests, alkali solubility tests, C.F.T.(G.) and T.D.T., laying stress on the effects of treatment, particularly of synthetic chemotherapy on the biological variations of the organisms.

Staining Methods—Do the gonococci consistently retain their classical gram-negative and morphological characteristics if obtained from varied sources and in spite of treatment or do they modify themselves in processes of adaptation, protection and propagation? Spitzer (1938) claims to have obtained astral, ring, dumbbell and vesicle forms in cases with negative gonococci findings, though they were infective. Jones (1938) finds that in sulphanilamide treated cases, the gonococci undergo changes in staining and spatial characters, the intracellular ones losing their morphology more than the extracellulars. Semmola and others maintain that the characteristics are better seen *in vivo* than *in vitro*. Here it may be repeated that in sulphanilamide treated cases though the urine is negative to gonococci, urethroprostatic smears may continue to remain positive; this indicates the gonococcicidal properties of the urine of these patients.

We have found that simple stains are useful for thin and double stains for thick smears and we invariably check these by Gram. In doubtful cases with a scarcity of gonococci in smears, Mihæloff (1937) finds their detection easier by Galli-Valerio, thymol blue method; Leszczynski uses theonine and picric acid, Von Wahl auramine, thionine and methyl green and Lanz thionine and fuchsin. Walton (1939) uses a modified Pappenheim-Saathof as selective stain for gonococci. For contrast stains, this author and Sandiford (1938) use a modified Gram-Pappenheim stain which differentiates Gram-positive from Gram-negative organisms and excludes cellular elements.

Culture Methods—The importance of cultural methods as confirmatory tests for staining methods cannot be too strongly emphasised in diagnosing neisserian infection, particularly in chronic cases with indeterminate clinical phenomena. How often do we feel puzzled in finding from the smears of the same fluid conflicting slide reports furnished by different laboratories. Van Slyke, Thayer and Mahoney's (1942) conclusions are illuminating; having supplied smears of 644 patients to three different microscopists of repute, 164 positive reports were received from one, 60 from the second and 44 from the third! Weiss and Colvin's paper on "The value of cultural methods for the diagnosis of gonococcal infections" is even more convincing; from a summary of 13,783 cases from the literature in which smear and culture tests were made and of these 4,482 were positive cases, a positive culture alone was 26·5 per cent and positive smears alone 10·5 per cent; smear-cum-culture positives over 62 per cent. Cox, McDermott and Hinton (1942) found in asymptomatic cases, prostatic massage fluid cultural tests to be five times as many positive as smear tests, revealing latent infection. Further, differentiation of other neisserian groups, N. flava, N. gigantia and the Mimeæ (which are really rod shaped but smears look like diplococci) from gonococci can only be made by cultural tests. On the other hand, there are rare occasions of positive smears and negative cultures which is apparently due to devitalization of the organisms. Two important problems face us in this connection. One is the transit hazard, the other being a florid growth of secondary organisms submerging the growth of gonococci. The wide range of temperature (T.D.T.) for the viability of gonococci would seem to simplify the problem. The thermos flask and the monotherm container devices may seem suitable but there are difficulties in their practical application, particularly in this country. On the whole it seems that earlier the media are inoculated the better. Heathman and Higginbotham (1941) favour the routine McLeod medium in iced thermos with added cystein and Price (1941) thinks that rubber corked tubes are satisfactory. In any case as far as possible, temperature below 38°C should be maintained. As gonococci remain viable in its native medium, Harrison (1941-42) recommends transport of material in capillary tubes and has found them viable for a number of days in room temperature.

Solid Culture Media—Apart from the usual laboratory media, some specific media with animal matter in its composition have been suggested. Glass and Kennett (1939) recommend blood charcoal and sugar charcoal or graphite addded to nutrient agar which facilitate the growth of gonococci and meningococci; if however chalk is added to it, it encourages meningococcal growth but not gonococcal, this would be a differentiating device. Bailey (1937) has devised a rather technically complicated method of preparing a medium for differentiating gonococcus and meningococcus. Gohring (1939) has found 20 per cent blood agar, using defibrinated human blood as the most suitable medium for gonococcus.

As sulphanilamide is an acknowledged 'inhibitor' Janeway (1941) has overcome the difficulty in culturing gonococci from materials of patients who have been taking this drug by adding 5 mg. per cent of para-aminobenzoic acid to all routine culture media.

Liquid Culture Media—Various liquid media with broth as the chief constituent have been used. Chin and Pang (1939) have found 4 parts of Tyrode's solution and 1 part of horse or human serum, particularly good for mass gonococcal culture. Gardner (1940) considers egg-white-ascitic fluid agar with Nile-blue A and a concentrated extract of vitamin B which show gonococcal colonies bluish green as a selective medium.

Tissue Culture Media—Li (1940) obtained growths in Tyrode's media with embryonic tissue in adult mouse spleen for gonococcal culture. Incidentally, he found wide variations in the size of gonococci in these cultures. Zinsser (1939) with others use agar tissue media, Morrow and Berry (1938) use chorioallantoic membrane and Osgood and Brownlee (1937) have used human marrow.

To prolong gonococcal longevity in cultures, liquid paraffin has been used by Kirsten and Fleischer (1938). The viability of gonococci in the male urine, has already been observed; Chin (*loc. cit.*) has found these viable for 24 hours if neces-

sary precautions are taken, these being immediate centrifugalization at low speed and the urine at pH 6·0 to 6·5. Here it may be interesting to repeat that in 7 of 16 sulphanilamide treated cases smears were positive but urine culture negative.

Fermentation, alkali solubility and gonophage tests—These tests are summarised in a tabulated form for purposes of differentiation: brain-agar-maltose tests (Pelouze, 1929), Thomson's alkali solubility tests by shaking suspension of bacteria in N/20 sodium hydroxide (Pelouze), gonococcus bacteriophage (gonophage) identification test (Pelouze and Schofield, 1927) by suspending bacteria and adding the gonococcal bacteriophage, 4 to 24 hours exposure (culture-incubation).

Organisms	*Fermentation brain-agar-dextrose*	*Fermentation brain-agar-maltose*	*Solution Thomson N/20 NaOH*	*Growth Gonophage*
Gonococcus	P	N	P	N
Meningococcus	P	P	P	P
M. Catarrhalis	N	N	N	P
Staphylococcus	P	P	N	P

P = Positive, *i.e.*, fermentation, solution, growth.
N = Negative, *i.e.*, no fermentation, not dissolved, no growth.

The complement fixation test—This test for gonorrhœa has not had unequivocal support of clinicians and serologists. Gohring (*loc. cit.*) obtained non-specific positive reactions in gonorrhœa, in infections by other organisms in experimental animals. While Jentsch, Zundel and others (1938) maintain that a positive C.F.T. indicates the presence of living gonococci in the patient, Studdiford, Casper and Scardon (1938) find that this test has given inconstant positive response in patients with positive cultures. Thus no more reliance can be placed on this than just a supporting diagnostic value. In some of our cases of possible latent infection with contradictory laboratory reports, C.F.T. has been some consolation.

Cutis test—By injecting into the papillary layer of the skin 0·1 c.c. of standard filtrate of gonococci and 0·1 c.c. of broth control, Corbus and Corbus Jr. (1941) have succeeded in producing a sharply circumscribed wheal with a rose-pink margin.

T.D.T.—Van Putte (1940) having studied the mortality of gonococci (in ascitic broth), ascertained that they were killed in 10 minutes and 30 seconds at 50°C, after 7 hours at 45°C and after a month at 41·5°C. Studying the T.D.T. of 250 strains of gonococci, Carpenter, Boak and Warren (1938) having obtained these from different foci, found a variation in the degrees of temperature and time. By some detailed methods of calculation, it may be ascertained if more than one strain of gonococci are present in the same individual. It may also be of some possible value in disputed medico-legal cases, by identifying the strains in the alleged male and female partners.

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JOURNAL OF THE
INDIAN MEDICAL ASSOCIATION
CALCUTTA, JANUARY, 1945

EMPLOYMENT OF WOMEN MINERS

Official reports published before 1937 show that there are about 385 collieries in India. Out of these only 72 had raising of more than 5,000 tons of coal per month. Previously in these coal mines the underground work was carried on by a motley crowd of men and women. The Government of India in recognition of its obligation under the International Labour Office Convention prohibited the employment of women underground. For some unknown reasons the ban was removed for 6 months and it has been decided again that it is not practicable to reimpose the ban immediately but the question is to be re-examined again very shortly. In this connection we draw the attention of our readers to a discussion in the House of Commons on October 12, 1944, published elsewhere in this issue.

The question of employment of women underground should be more thoroughly examined. During the last five years of War in England, women have taken over men's job in different industries to cope with the man power shortage or releasing men for work in areas where women are unsuitable. But uptil now women have not been allowed to work underground in the coal mines. Why the ban so long imposed in India has suddenly been lifted? This is apparently due to the demand of interested parties for longer hours and lower wages. It is an open secret that women work on a lower scale of pay than men and hence perhaps the lifting of the ban.

Women should not be allowed to work underground mainly for two reasons: *Firstly,* because of the environment in the coal mines; *secondly,* work of this nature is unsuitable for the health of women. Among the existing collieries many date from the pre-public-health time and according to modern standards are badly planned, insanitary and ill ventilated. Many of the collieries are too small to be good units of production. A large number are defective in equipment and some in management. On the other hand there are a number of collieries which are admirably planned, equipped and managed. The women miners may be cheap but because of the inferior muscular capacity of women, the output is much lower when compared to that by men. The method of cutting the seams and raising the coal require a strength which is not possessed by an average woman. Even in mines where modern machinery is used and much physical strength is not needed there remains a huge field of activity requiring considerable muscular strength. In addition to the work in damp, dust and darkness, our women have domestic responsibilities peculiar to this country. Moreover, attendance of women is generally irregular due to their regular ill health and pregnancy. Mr. Amery gave an evasive reply to the qustion. "Could Amery not answer the question we asked him about a year ago whether pregnant women were prohibited from going underground?" To this evasion Mr. George Griffiths, M.P., retorted "It is a crying shame." 'Shame indeed! There seems to be no law, national or international to stop this inhuman torture to pergnant women. Medically and even from humanitarian reasons pregnant women should not be allowed to do hard manual work, not to speak of working underground. Constitutionally they are unfit for such work. Malnutrition, pregnancy, lactation and domestic duties, all sap their vitality. We appeal to the legislatures to pass a law immediately to stop this disgraceful practice. Nobody is gainer by this. Sir A. Ramaswamy Mudaliar, Supply Member, pointed out in the Council of State on November 9 that the government had fixed the rates for certain qualities of coal from Rs. 9-8-0 to Rs. 10-0-0 per ton as against the average price till 1942 which was about Rs. 3-0-0 per ton, the coal production as admitted by Mr. Amery shows a decline of about 4½ per cent since 1943. If the ban was lifted as a war measure, it has not benefited the war effort in any way. There is no lack of man power in India with its 400 million of inhabitants. India's population has been used in and out of season by cheap propagandists as the bottleneck for advancement in all the spheres in which our country is backward. Lately it has been displayed as a cause of famine and malnutrition. One cannot believe that if attempts were made to induce more male workers to mines by increased wages, there would have been any dearth of labourers. At present there is no appreciable shortage of labourers in the vast war work in any part of the country where the pay is reasonable and attractive.

To the mine owners we appeal to drop this practice of employing women underground. For their profit they should look in other directions than employing women on lower wages compared to men. We think the methods of utilising coal are unscientific. About four-fifths of the coal consumed in the country is burnt in a raw state; oil and valuable bye-products are wasted and the atmosphere is polluted. Mining, in many places, should be intimately associated with several other industries—with gas, electricity, smokeless fuel, oil, chemical and medicinal products, blast furnaces and coke ovens. A beginning has been made towards this combination but it is not more than a beginning. The selling organisations and the method of transport are too expensive and do not secure the best financial results for the collieries and therefore for the miners in them. In our view employment of women and lower wages are no solution. Larger changes are necessary in the above directions and large progress is possible.

NOTES AND NEWS

INDIAN RADIOLOGICAL ASSOCIATION

Radiologist in any part of India may kindly send in his name and address to the Secretary of the Indian Radiological Association, 4, Cooper Street, Calcutta, so that a circular letter of interest to his speciality may be forwarded to him by the Secretary.

COATES MEDAL OF THE CALCUTTA UNIVERSITY

Dr. Harendranath Mukherjee, B.SC., M.B., D.I.C. (LOND.) of the Carmichael Medical College, Calcutta, and a Sectional Secretary of the Journal of the Indian Medical Association has been awarded the Coates Medal of the Calcutta University for the year 1938 and Dr. B. Mukerji, M.B. (CAL.), M.D., D.SC. (MICH.), Director, Biochemical Standardisation Laboratory, Calcutta, that for the current session for the best scientific contributions for the last seven years.

WOMAN PROFESSOR OF OBSTETRICS AND GYNAECOLOGY

Mrs. Bertram Lloyd has been appointed to the chair of obstetrics and gynæcology in the University of Birmingham, left vacant by Sir Harold Beckwith Whitehouse, who died when he was president of the British Medical Association. Mrs. Lloyd graduated in science in 1914 and in medicine two years later at Birmingham University. She then became medical officer to the Maternity Hospital and the Midland Hospital for Women. In 1920 she took the fellowship of the Royal College of Surgeons and became obstetric surgeon to the Maternity Hospital and acting surgeon to the Hospital for Women. In 1930 she married Mr. Bertram Lloyd, who is professor of forensic medicine and lecturer on clinical surgery at the University of Birmingham. Mrs. Lloyd was appointed assistant to the chair of obstetrics before succeeding to it.—*J.A.M.A.*

KASTURABA GANDHI NATIONAL MEMORIAL FUND

A sum of Rs. 58,471 has been collected as a result of special effort by members of the medical profession in Bombay as their contribution to the Kasturaba Gandhi National Fund as under:

Staff (including retired Members of the Staff) and Students

	Rs.
1. Seth G. S. Medical College and K.E.M. Hospital	22,376
2. Grant Medical College and J. J. Group of Hospitals	15,939
3. National Medical College and Bai Yamunabai Nair Hospital	3,756
4. Other members of the medical profession ..	16,400
Total	58,471

The principal contributions are as follows:

	Rs.
Dr. P. C. Bharucha	5,500
Sir Mangaldas Mehta	2,500
Drs. N. A. Purandhare; R. N. Cooper; S. R. Mulgaokar; A. J. Kohiyar, *each*	2,000
Drs. K. T. Gajjar and R. S. Tirodkar, *each* ..	1,500
Drs. Shantilal Mehta and A. K. Baliga, *each* ..	1,001
Dr. and Mrs. Gilder; Drs. B. P. Banaji; J. P. Parekh; V. N. Shirodkar; and "A Doctor" (Anonymous) *each*	1,000
Drs. Miss J. Jhirad and T. O. Shah	600
Drs. A. P. Bacha; B. B. Yodh; Gajanan Mahimtura; Venkat Rao; and Dr. Miss Kumud Mehta, *each*	501
Drs. N. D. Patel; K. G. Munsif; Mangaldas Shah; G. Coelho; Major S. B. Mehta; A. S. Erulkar; "From a Friend" and "Anonymous", *each* ..	500
Dr. Jamnadas Dacka	401
Drs. Jivraj Mehta; Hiralal Doctor; R. J. Vakil; Bhasker Patel, *each*	351
Drs. M. G. Pradhan; Chandulal Vithaldas; V. M. Desai; Mohanlal Shah; H. V. Tilak, *each* ..	350
	Rs.
Drs. N. J. Thanawalla; S. N. Sharma and K. N. Karanjia, *each*	301
Dr. Hirabhai S. Patel	276
Drs. K. M. Bhansali; Kalyandas and Vasant K. Desai; G. K. Adhvariyu; R. A. F. Cooper; Keshavlal M. Shah and Chamanlal Mehta, *each*	251
Drs. Jal Patel; M. B. Mody; D. M. Desai; Vero P. De Sa; S. N. Deboo; Vithaldas J. Mody; S. Patro; Shantilal Sanghani; S. V. Gokhale; R. M. Patadia; "Sympathiser"; S. S. Krishnan; Mukund Kothare; Dr. and Mrs. R. T. Desai; V. M. Kerker; E. B. Billimoria; C. N. Shroff and S. S. Ugrnker, *each*	250
Drs. K. K. Dalal; S. N. Mulki; Nagindas N. Shah, *each*	201
Prof. R. P. Koppikar; Drs. M. M. Pandya; H. Maniar; M. J. Permanand & K. M. Masani, *each*	200
Drs. D. S. Alerja and A. C. Rebello, *each*	151
Drs. Afzalpurkar; H. D'Sa; P. M. Wagle; A. Karamally; B. C. Das Gupta and A. D'Sa, *each* ..	150
Drs. S. M. Kamli; H. D. Dastur; M. L. Mistry; K. G. Das; "Medical Practioner"; N. G. Mody; J. J. Merchant; "Anonymous"; J. K. Thanawalla; M. D. Adatia; M. L. Kapadia; W. N. Welingker; J. L. Desai; S. G. Joshi; Rajderker and J. S. Nerulkar, *each*	101

It is further expected to receive some more contributions to the Fund from doctors during the course of the next few days.

MALARIA IN BENGAL

The following are extracts from a statement which was laid on table of the Bengal Assembly on Monday in reply to a question of Dr. Nalinaksha Sanyal showing the total number of deaths in different districts of Bengal from malaria during the first four months of the year, 1944:—

	Jan. 1944	Feb. 1944	Mar. 1944	April 1944
Burdwan ..	3,483	2,195	2,459	2,339
Birbhum ..	4,871	3,231	2,383	1,762
Bankura ..	1,857	1,039	801	710
Midnapur ..	2,421	1,889	1,766	2,577
Hooghly ..	1,025	854	752	700
Howrah ..	677	521	461	..
24-Parganas ..	2,692	1,684	1,296	1,228
Calcutta ..	323	252	214	247
Nadia ..	7,605	4,700	4,155	3,941
Murshidabad ..	5,662	4,207	3,645	3,077
Jessore ..	4,373	3,465	3,836	..
Khulna ..	1,844	1,256	1,176	..
Rajshahi ..	3,513	2,875	2,578	..
Dinajpur ..	2,251	1,904	1,815	1,436
Darjeeling ..	252	258	256	247
Jalpaiguri ..	1,158	917	809	1,207

	Jan.	Feb.	Mar.	April
Rangpur ..	5,262	4,034	3,086	3,055
Bogra ..	2,128	1,389	1,743	..
Pabna ..	4,149	3,338	2,946	..
Malda ..	3,879	3,166	2,186	1,658
Dacca ..	7,493	4,993	3,067	..
Mymensingh ..	14,351	9,716	7,673	..
Faridpur ..	8,141	5,023	4,596	..
Barisal ..	5,589	3,051	2,196	..
Chittagong ..	1,875	1,239	1,010	..
Noakhali ..	972	704	794	..
Tipperah ..	9,066	6,710	4,152	3,867

—*A. B. Patrika.*

EMPLOYMENT OF WOMEN MINERS

Mr. Amery told that months after the ban on the employment of women underground had been lifted the Government of India, in accordance with their undertaking, reviewed the position. In spite of all other measures taken to increase the coal production, it remained much below the requirements and the situation is serious. The Government of India were, therefore, forced reluctantly to the decision that it was practicable to reimpose the ban immediately, but the question is to be re-examined again very shortly.

Mr. Amery was replying to Mr. Hynd (Labour) who had asked whether Mr. Amery would make representations to the Government of India to ensure recognition of its obligations under the International Labour Office Convention concerning employment of women underground.

Mr. Cove (Labour): Does Mr. Amery contend that there are not enough men in India not to go underground, leaving the women completely outside? Is there a shortage of man-power in India?

Mr. Amery: The Government of India have made every effort to recruit male labour from other parts of India.

Mr. Cove: But is there a shortage of man-power in India?

Doctor Edith Summerskill (Labour): Could Mr. Amery not answer the question we asked him about a year ago whether pregnant women were prohibited from going underground?

Mr. Amery said that women were doing certain work underground in seams over 6 feet in height.

Dr. Edith Summerskill: Could he answer whether pregnant women are prohibited from going underground?

Mr. Amery: I think they are, but I will make sure on the point.

Dr. Summerskill: It is absolutely disgraceful.

Mr. George Griffiths (Labour): It is a crying shame.

Mr. Campbell Stephen (Independent Labour Party): Will he say if it is the case that a similar practice is going to be put in operation in this country with regard to women working underground?

Mr. Amery: No sir. As I said, I am not aware that at present pregnant women are working underground.

Mr. Sorenson (Labour): Has any attempt been made to induce more male workers to mines by increased wages. How much extra coal has been produced by women?

Mr. Amery: Yes sir, every effort is being made to secure male workers from other parts of India. I gather that coal production since last year shows a decline of about 4½ per cent.

Mr. Sorensen: Then women have produced less than men.—*Reuter.*

PENICILLIN SUPPLIES FOR PUBLIC

Penicillin is now available in Delhi, Calcutta, Bombay, Karachi and Madras with Messrs. Kemp & Co., Bombay, Madras, Calcutta and Delhi, Messrs. Parke Davis & Co., Bombay, Madras and Karachi; Messrs. Smith Stanistreet & Co., Calcutta; Messrs. Martin & Harris, Calcutta; Messrs. T. M. Thakore & Co., Bombay, Messrs. Volkart Brothers, Bombay and Messrs. D. M. Wadia & Co., Bombay.

In order to ensure that the available supplies are equitably distributed, Penicillin is controlled by a Board, set up by the Government of India. This Board is styled the Central Penicillin Control Board with the Director-General, Indian Medical Service as its Chairman. The Board has already issued some instructions on the use and method of procurement of Penicillin by Medical practitioners.

Penicillin, in the first instance, will be supplied only to approved institutions, authorised to use this drug by or under the authority of the Board. Any stocks remaining over each month after the various provinces have been allotted as much as they require will be sold by importers direct to medical practitioners and non-government institutions under the following control:

Every request for supply of Penicillin in such cases must emanate from a medical practitioner and should be accompanied by a certificate that the case for which penicillin is required is suitable for treatment which should be signed by an Administrative Medical Officer *i.e.* a Surgeon General, Inspector General of Civil Hospitals, Residency or Agency Surgeon, or any of the "assessors" nominated by him for the purpose. These assessors will ordinarily be surgeons or specialists who have access to a suitable bacteriological laboratory.

In order to judge whether the use of penicillin is justified the "assessors" will require particulars of the case which must include the diagnosis of the case, bacteriological findings, the dosage, the mode in which penicillin is proposed to be administered and also the quantity required. If the assessors are satisfied they will sign a certificate that the case is suitable for penicillin treatment stating how much penicillin is to be used. The importer on receipt of such a certificate will issue the amount of penicillin prescribed thereon. It is incumbent on every medical practioner or institution obtaining penicillin to submit a case report through the Government Assessor on the prescribed Penicillin Chart copies of which have been distributed to Provincial and State Medical authorities.

ALL-INDIA OPHTHALMOLOGICAL SOCIETY

The Eighth Conference of the All-India Ophthalmological Society will be held in Hyderabad, Deccan, on the 8th, 9th and 10th March, 1945. The subject for a symposium will be GLAUCOMA. All ophthalmic practitioners are invited to become members of the Society. Further particulars can be had from one of the Secretaries, Dr. G. Zachariah, 16, Marshall's Road, Egmore, Madras, or Dr. B. N. Bhaduri, 45, Chittaranjan Avenue, Calcutta. Copies of papers and communications to be read before the Conferences should be submitted not later than January 31, 1945. Members are requested to inform the Secretaries of any change of address.